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THE EARTH OBSERVER

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## Editor's Corner

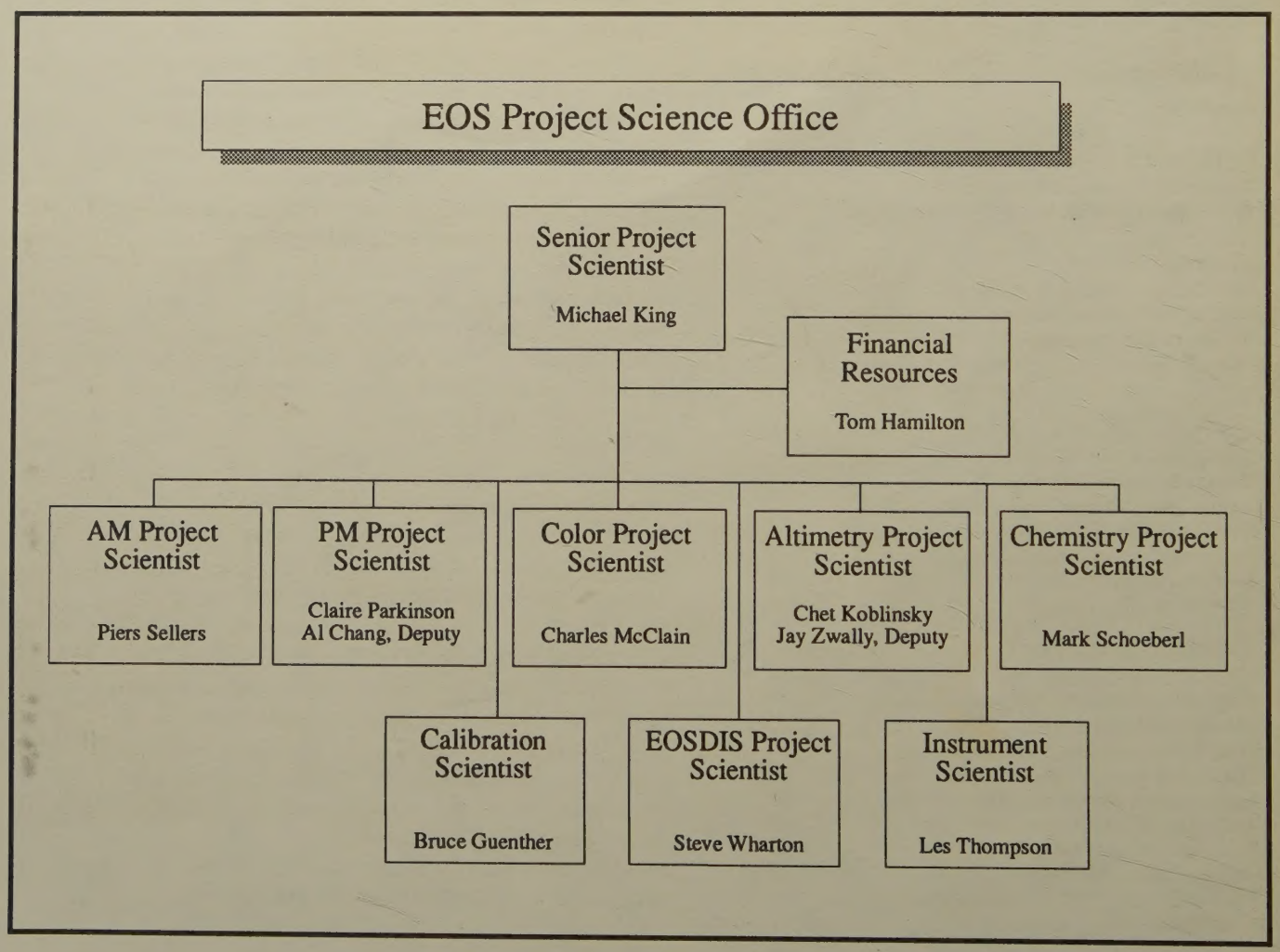
Following ESA's January decision in which they indicated their intent to provide a MIMR for the EOS PM-1 satellite, both Europe and NASA have been working on formulating an international MIMR Science Team (known as the MIMR Science Advisory Group in Europe). On May 25, Dr. Shelby Tilford approved the proposed investigations of seven team members from the U.S., four or five of whom will be named official members of the international MIMR Science Team. All seven of these scientists will be supported by NASA to develop algorithms for processing MIMR data, with particular emphasis on ocean and sea-ice applications. The European members of the Science Team, with emphasis on land remote-sensing applications, have now been selected.

In the last several issues I have reported the appointment of key scientists within the Earth Sciences Directorate as Project Scientists of individual EOS spacecraft missions. I am happy to report that Dr. Steve Wharton has agreed to be the EOSDIS Project Scientist, replacing Dr. Robert Price who has assumed new responsibilities as Director of the Mission to Planet Earth Office. Dr. Wharton has served as the Project Scientist of the Pilot Land Data System (PLDS) and the lead scientist of the Land Analysis System (LAS), developed at Goddard and now used by a large number of universities and agencies across the U.S. His new duties as the EOSDIS Project Scientist will both complement and be congruent with his position as Chief of the Global Change Data Center, within which the Goddard DAAC resides.

An EOS Science Executive Committee meeting was held on July 6 in Chicago, the main purpose of which was to address the roles and responsibilities of the SEC, the IWG, the EOS Project at Goddard and the EOS Program at NASA Headquarters. Many felt that the SEC should look beyond short-term issues and establish long-term directions and visions for the EOS program. Discussion focused on ways and means to increase the visibility and awareness of the many significant achievements thus far obtained, viz., Pathfinder Data Sets, EOSDIS Version 0, modeling accomplishments of the EOS PIs, and precursor data sets obtained in a wide variety of airborne field campaigns using sensors that simulate many EOS sensors being developed. Finally, a very lengthy and productive discussion ensued on the functions and responsibilities of various IWG Panels, and the need to eliminate some panels, split others, and create some new panels. No consensus on a panel structure was reached, though there was widespread consensus that the Calibration/ Validation Panel should be split into two distinct panels, and an Outreach Panel should be established. The SEC will re-visit the panel structure at a future meeting in October and report to the entire IWG.

Note: Please notice the postage-paid card at the back of this issue. Your reply is important, as it will ensure that you continue receiving *The Earth Observer,* while allowing us to streamline our data base. Please take care to print legibly. Your cooperation is greatly appreciated.

—Michael King
EOS Senior Project Scientist



Michael King, EOS Sr. Project Scientist (Left), Robert Price, Director of Goddard Space Flight Center's Mission to Planet Earth Office (Center), John Dalton, EOS Earth Science Data and Information System Project Manager (Right), at the Global Change Policy Symposium at the National Press Club.

Back row, from left to right: John Dalton, EOS Earth Science Data and Information System Project Manager; R. Adm. James Koehr (Ret.), Director, Advanced Programs, Hughes Applied Information Systems (HAIS); Saul A. Volansky, Vice-President, Engineering, Hughes Information Technology Corp. (HITC). Front row, from left to right: Michael King, EOS Sr. Project Scientist; Tony Calio, President, HAIS; Berrien Moore, Chairman of the EOS Payload Advisory Panel; Jenanne Murphy, Vice President, HAIS, at the Global Change Policy Symposium at the National Press Club.

# GSFC's New Mission to Planet Earth Office Reorganization is the Key to Success

—**Robert Price**, Director of Mission to Planet Earth Office, GSFC

On April 18, 1993, Goddard Space Flight Center (GSFC) Director John Klineberg established the Mission to Planet Earth (MTPE) Office at Goddard. The new Code 170, a directorate-level organization reporting to Klineberg, was created to streamline management and to provide greater overall mission integration of Earth Observing System (EOS) project elements and related Mission to Planet Earth activities as appropriate. The objective of MTPE is to create an integrated observing and data system that will improve understanding of the Earth as an integrated system, and to develop and apply the predictive capabilities needed to aid policy-makers.

Robert Price, formerly Deputy Director of Earth Sciences at Goddard, was appointed Director of the new Office. Richard Austin, formerly Deputy Associate Director of Flight Projects for EOS Resources Management, was named Deputy Director for Resources for the MTPE Office.

The reorganization is intended to accomplish three goals: (1) to improve the overall coordination of all MTPE activities; (2) to improve senior management visibility into MTPE activities, improve senior management participation in planning and guidance, and raise organizational importance; and (3) to provide better Goddard internal functional alignment with the new NASA Headquarters internal functional alignment.

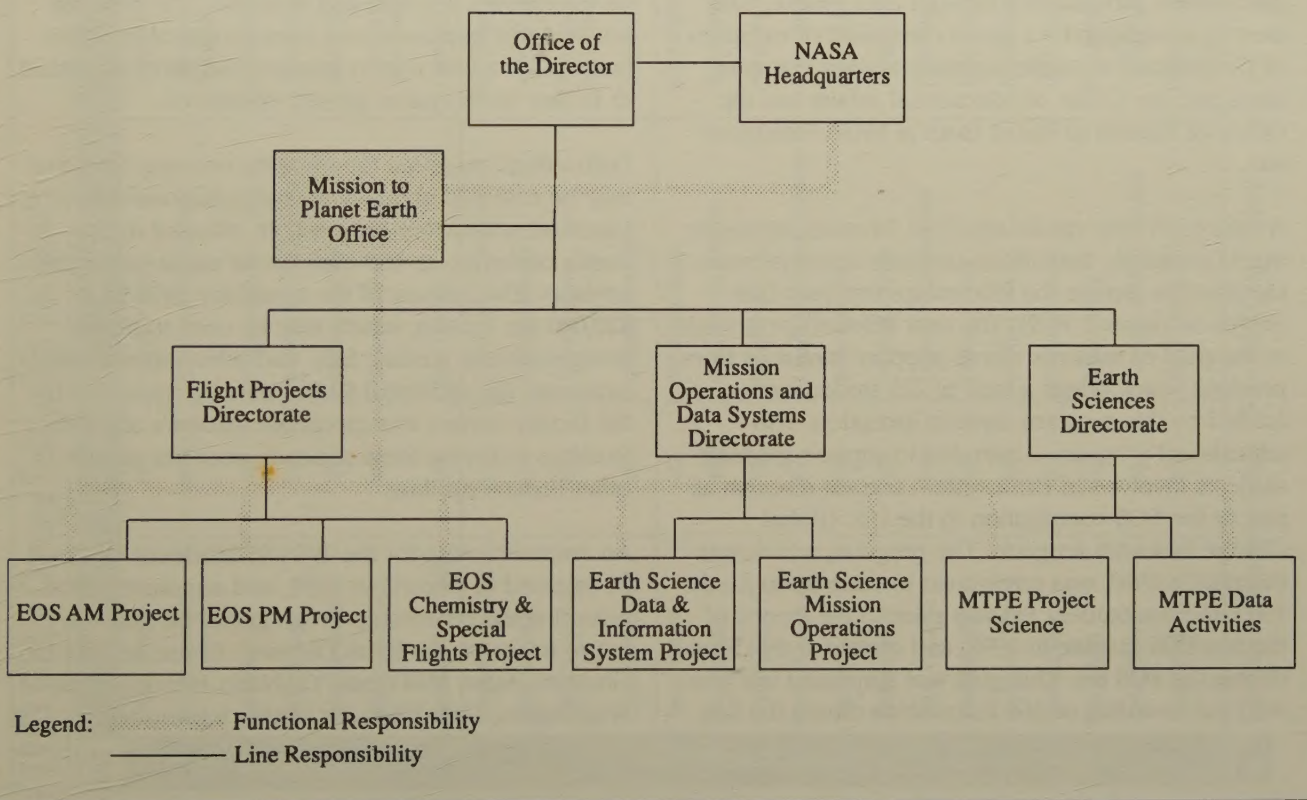
The GSFC MTPE Office is, among other things, the primary interface between Goddard's Mission to Planet Earth efforts and the NASA Headquarters Office of Mission to Planet Earth. These efforts include not only the overall management of the spacecraft, instruments, and data system for EOS missions, but also the overall integration of Earth Probes and other Earth sciences mission activities such as the Upper Atmosphere Research Satellite (UARS) and Landsat into MTPE, and oversight of budget and schedule. Code 170 also acts as the focal point for all Goddard MTPE non-technical interfaces and activities, and as the liaison to other communities interested in MTPE, such as Congressional and Administration staff, media, and the public.

EOS functions at Goddard are distributed over three Directorates. The Flight Projects Directorate (Code 400) works primarily on instrument and spacecraft design and construction. The Mission Operations and Data Systems Directorate (Code 500) is responsible for developing the data and information systems for EOS (EOSDIS). The Earth Sciences Directorate (Code 900) provides requirements for the mission and the Project Scientist for both EOS and the Earth Probes, as well as the Pathfinder data sets, the GSFC Distributed Active Archive Center, and Earth Probe data systems. Code 170's role is to oversee the work of all EOS and related Earth Probe activities in all three Directorates, coordinate the efforts, and integrate the entire assembly seamlessly into Mission to Planet Earth activities.

Under MTPE Office guidance, the talent, dedication, and creativity of Goddard's scientists, data system developers, and spaceflight engineers are being tapped, guided, and integrated to ensure that GSFC's contribution to Mission to Planet Earth remains on target to accomplish its goals.

Shelby Tilford (Left), Acting Associate Administrator, Office of Mission to Planet Earth, NASA Headquarters, greets Robert Price (Right), Director, Goddard Space Flight Center's Mission to Planet Earth Office, at a recent Global Change Policy Symposium at the National Press Club.

Goddard Space Flight Center
Mission to Planet Earth
Organizational Structure



# NASA SELECTS SIXTY-FIVE NEW GRADUATE STUDENT FELLOWS

The selection of this year's recipients of NASA Graduate Student Fellowships in Global Change is complete. A total of 314 applications were received by the Office of Mission to Planet Earth at NASA Headquarters in response to the announcement (*The Earth Observer*, Volume 4, No. 6), released in November, 1992. In all, over 95 universities and educational institutions from 44 states were represented. The applicants represent 27 countries, however, they are all currently accepted/enrolled as full-time PhD graduate students at one of the 95 universities in the United States.

The applications were evaluated through a two-step peer-review process, first through mail review, and then by evaluation by a panel composed of members of professional scientific societies, academic institutions, and the Office of Educational Affairs and the Office of Mission to Planet Earth at NASA Headquarters.

A total of 65 new candidates from 24 states representing 35 academic institutions and nine countries were identified to receive the fellowships this year (see Tables on pages 7, 8, 9). The new fellowships, added to the pool of students whose support continues from previous years, brings a total of 225 students now funded by this program since its inception. This educational program is intended to support graduate students involved in Earth system science research as part of the EOS contribution to the U.S. Global Change Research Program. The program, which was initiated in 1990, was envisioned to scale up to fund 150 Graduate Student Fellows prior to the launch of the first EOS satellite in 1998, and remain at that level during the EOS era. This goal was surpassed last year with the awarding of 164 fellowships during the first three years of the program due to the overwhelming response (more than 1300 applicants) during this period. It is now intended that the program will scale up to fund 200 Graduate Student Fellows per year prior to the launch of the first EOS satellite in 1998. The first group of approximately 35 students funded in previous years has either graduated or will graduate this year.

The purpose of the Fellowship Program is to train a pool of highly qualified scientists to help analyze and interpret the wealth of data generated prior to and during the EOS era. NASA understands that the future of Earth science rests with today's students, who will be tomorrow's teachers and scientists. The financial wherewithal to pursue an advanced education obviously plays a vital role in securing the necessary talent to further Earth system science objectives.

Fellowships are given for an initial one-year term and may be renewed annually for two additional years, based on satisfactory progress, as reflected in academic performance and evaluations made by faculty advisors. The amount of the award for 1993-94 is $20,000 per annum, which may be used to defray living expenses, tuition, fees, and other educational expenses. An additional $2,000 may be requested by the faculty advisor to support the student's research. Students receiving these stipends must not receive other Federal funding.

An announcement for the 1994-95 academic year will be released in December 1993, and announcements regarding the Fellowship Program will be made in future issues of *The Earth Observer*. Please contact Dr. Ghassem Asrar, Mail Code YS, NASA Headquarters, Washington, D.C. 20546 for further information. ▩

# 1993 Global Change Fellowship Recipients

| GCC | Fellow | Citizenship | Institution | Proposal Title |
|---|---|---|---|---|
| Biogeochemical Dynamics | Barnes, Diana H. | USA | Harvard University | Sources and Sinks of Greenhouse Gases in Forest Ecosystems: A Novel Application of Conditional Sampling |
| | Colmer, Timothy D. | Australia | University of California, Davis | Determination of the Relationships Between Leaf Reflectance Spectra and Leaf Physiological State of Salt Stressed Spartina Alterniflora for Use in Remote Sensing |
| | Foley, David, G. | USA | University of Southern California | A Model of Coupled Biological and Physical Processes in the Equatorial Pacific During the 1991-1992 ENSO Event |
| | Goldfarb, Leah | USA | University of Colorado, Boulder | Photodissociation of Atmospheric Chlorine Species: C100C1 and C10N02 |
| | McKenzie, Lisa Marie | USA | University of Montana | Emission of Halocarbons from Biomass Burning |
| | McSwiney, Claire P. | USA | University of New Hampshire | Control of Nitrous Oxide Loss Across a Tropical Rain Forest Ecosystem in the Luquillo Forest, Puerto Rico under Baseflow and Storm Conditions |
| | Megonigal, James Patrick | USA | Duke University | Feedbacks of CO2-Fertilization and Temperature on Methane Emissions |
| Climate and Hydrologic Systems | Bergman, John William | USA | University of Colorado, Boulder | The Diurnal Cycle of Atmospheric Water Vapor and Clouds and Its Impact on Regional and Global Energy Budgets |
| | Byrne, Deirdre A. | USA | Columbia University | Agulhas Eddies: Assessing the Impact of Mesoscale Variability on Ocean Circulation |
| | Ciach, Grzegorz Jan | Poland | University of Iowa | Statistical and Physical Framework for Design and Verification of Climatological Precipitation Estimation Methods Using Remote Sensing Measurements |
| | Czajkowski, Kevin Paul | USA | University of Michigan | The Impact of Runoff on the Hydrologic Cycle: Application to Temperate and Tropical Watersheds with Emphasis on Wetlands |
| | Decker, William J. | USA | University of Virginia | Nodal Methods for Meteorological Models |
| | Early, David S. | USA | Brigham Young University | Remote Satellite Observation of Polar Ice and Snow Cover |
| | Enxleben, Wayne H. | USA | University of Arizona | Assessment, Characterization and Modeling of Aerosol Temporal - Spatial Properties for Use in Global Climate Change Studies |
| | Evans, Michael N. | USA | Lamont-Doherty Earth Observatory | Natural Variability, Evolution, and Response of the Southern Oscillation to Global Climate Change |
| | Frei, Allan | USA | Rutgers University | Anthropogenic Global Climate Change Detection Using Remotely- Sensed Northern Hemisphere Snow Cover Data |
| | Goddard, Lisa M. | USA | Princeton University | The Energetics and Predictability of the El Nino - Southern Oscillation |
| | Gupta, Mohan Lal | India | University of California, Irvine | A 2-Dimensional Photochemical Study of Light Nonmethane Hydrocarbons in the Troposphere |
| | Haferman, Jeffrey L. | USA | University of Iowa | Three-Dimensional Radiative Transfer in Cloudy Precipitating Atmospheres |
| | Haverkamp, Donna S. | USA | University of Kansas | A Methodology for Classifying Remotely Sensed Sea Ice Cover for Global Change Applications |
| | Horowitz, Larry | USA | Harvard University | Effect of Anthropogenic Emissions from North America on the Global Tropospheric Budget of NOY |
| | Jipp, Peter H. | USA | Duke University | Evapotranspiration in Seasonally Dry Amazonian Ecosystems: Water Budget Responses to Forest Removal and Regrowth |
| | Karner, Daniel B. | USA | University of California, Berkeley | Testing the Milankovitch Theory of Climate Cycles by Single Crystal 40Ar/39Ar Dating of Coastal Pleistocene Volcanics |
| | Knabb, Richard D. | USA | Florida State University | Monitoring Aspects of Water Vapor Structure and Transport Which Influence Climate Variability Using the New Capabilites of GOES I |

**KEY** DIS = Data and Information Systems GCC = Global Change Category

# 1993 Global Change Fellowship Recipients

| GCC | Fellow | Citizenship | Institution | Proposal Title |
|---|---|---|---|---|
| Climate and Hydrologic Systems | Kohfeld, Karen E. | USA | Columbia University | North Atlantic Surface Ocean Response to Younger Dryas Cooling as Recorded in Planktonic Foraminifera, and Its Implications for Rapid Climate Change |
| | Lin, Xin | China | Colorado State University | Investigation of Heating and Moistening Evolution Over Western Pacific Warm Pool Region and Its Relation to the 30-60 Day Oscillation |
| | Liu, Hong | China | Texas A&M University | Remote Sensing of Temperature (Sound Speed) in the Ocean Using Brillouin Scattering |
| | Masters, Jeffrey M. | USA | University of Michigan | Vertical Transport of Boundary Layer Trace Gases by Mid-Latitude Cyclones |
| | Mauget, Steven A. | USA | University of California, Davis | Divergent Influences and Intraseasonal Teleconnections: An Observational Study Using ISCCP Cloud Cover Data |
| | Mauzerall, Denise L. | USA | Harvard University | The Influence of Fossil Fuel and Biomass Combustion on Ozone Concentrations in the Remote Troposphere |
| | McCollum, Jeffrey R. | USA | University of Iowa | Rainfall as a Space-Time Process and Its Climatology Estimated from Space |
| | McManus, Jerry F. | USA | Columbia University | North Atlantic Ice Rafting Events and Rapid Climate Change |
| | Morris, Gary Allen | USA | Rice University | Analysis of the Structure and Evolution of the Arctic Polar Vortex |
| | Myrick, Jennifer M. | USA | University of Colorado, Boulder | Analysis of Errors Affecting Satellite Altimeter Data for Global Change Applications |
| | Nicholson, Shaun R. | USA | University of Kansas | The Measurement of Vertical Velocities in Convective Storms Using Airborne Doppler Radars |
| | Oxburgh, Rachel | Britian | Columbia University | Variations in the Isotopic Composition of Osmium in Seawater Over Time |
| | Perica, Sanja | Croatia | University of Minnesota | Physically-Based Subgrid Scale Statistical Parameterization of Rainfall: Coupling Mesoscale Meteorology with Small Scale Scaling Descriptions |
| | Pierson, James M. | USA | University of California, Irvine | Mechanistic and Experimental Studies of Halogen Oxide Species Important in the Lower Stratosphere |
| | Rohli, Robert V. | USA | Louisiana State University | Changes in the Frequency of Polar Air Masses Over the Central Gulf Coast Associated with Atmospheric Teleconnections |
| | Sayler, Bentley J. | USA | University of Washington | Study of Cloud Mixing Processes and Dynamics Through Laboratory Simulations |
| | Thorton, Peter E. | USA | University of Montana | Development and Testing of a Two-Way Coupling Between Land Ecosystem and Mesoscale Atmospheric Dynamic Models on a Regional Scale |
| | Voemel, Holger W. | Germany | University of Colorado | Measurements of Stratospheric Water Vapor in the Tropics and Over Antarctica |
| DIS | Cloud, John G. | USA | University of California, Santa Barbara | Exploring the Potential of Space Shuttle Earth Observations Photography as Metadata to Access and Manage Earth System Data |
| | Goldschneider, Jill R. | USA | University of Washington | Lossy Compression of Multi Spectral Digital Satellite Images |
| | Yurcik, William J. | USA | Carnegie Mellon University | Maximization of Direct Federal Investment in National Computer Network Infrastructure |
| Eco-systems Dynamics | Anyamba, Asaph | Kenya | Clark University | Time Series Analysis of Vegetation Response to Climatic Variations Using Satellite Derived Normalized Difference Vegetation Index Data: Observations Over Africa During the 1981-1991 Period |
| | Cai, Guoray | China | West Virginia University | Spatial Models of Vegetation Dynamics and Global Change |

KEY DIS = Data and Information Systems GCC = Global Change Category

# 1993 Global Change Fellowship Recipients

| GCC | Fellow | Citizenship | Institution | Proposal Title |
|---|---|---|---|---|
| Eco-systems Dynamics | Edwards, Joanne Y. | USA | Florida State University | Resolving a Major Discrepancy Regarding the Importance of Rhizospheric Methane Oxidation |
| | Kneller, Margaret L. | USA | Columbia University | Vegetation and Climate Records from the U.S. Southeast: Glacial to Holocene Changes |
| | Kupferberg, Sarah J. | USA | University of California, Berkeley | Climate Change and the Invasibility of River Communities |
| | Lewis, Gregory P. | USA | Cornell University | Effects of Forest Composition Changes on Export of Organic Matter from Headwater Streams |
| | Sachs, Donald L. | USA | Oregon State University | The Effect of Forest Management on Carbon Storage by Engelmann- Spruce- Subalpine Fir Forests in British Columbia |
| | Shaw, Mary R. | USA | University of California, Berkeley | Ecosystem and Population Consequences of Climate Change in a Montane Meadow |
| | Suzuki, Marcelino T. | Brazil | Oregon State University | The Effect of Protistan Bacterivory in Bacterioplankton Diversity |
| | Voss, Paul B. | USA | Harvard University | Heterogeneity of Carbon Dioxide in Forest Ecosystems |
| | Yang, Jingli | China | University of Maryland, College Park | African Savanna Vegetation Changes Using Historical Landsat Archive |
| Human Interactions | Horne, L. Christine | USA | University of Arizona | Micro-Level Social Determinants of the Greenhouse Effect |
| | Lehman, Paul H. | USA | University of Texas, Austin | Human Interaction with the Earth's Environment in Long-Term Perspective |
| | Litvak, Marcy E. | USA | University of Colorado, Boulder | The Effects of Resource Availability and Herbivory on Monoterpene Emissions from Conifers |
| | Steininger, Marc K. | USA | University of Maryland, College Park | Monitoring the Fates of Cleared Land in Amazonia |
| | Walker, Wendy M. | USA | Johns Hopkins University | Conserving Madagascar: A Comparative Study of Local and International Approaches |
| Solid Earth Processes | Childers, Vicki A. | USA | Columbia University | Precise GPS Positioning to Study the Geologic Influences on the Stability of the West Antarctic Ice Sheet |
| | Nicoll, Kathleen A. | USA | University of Arizona | Sedimentary Evidence for Climate Change in the Western Desert, Egypt |
| | Schneider, David Joseph | USA | Michigan Technological University | Satellite Observations of Explosive Volcanic Eruptions: The Fate of Silicate Particles in the Atmosphere |
| | Yuhas, Roberta Hope | USA | University of Colorado, Boulder | Landscape Response to Holocene Climate Change: Evidence from Remotely Sensed Data and Ground-Based Studies in Northeastern Colorado |

KEY DIS = Data and Information Systems GCC = Global Change Category

Panel Report

# Atmospheres

(From the March 29 - April 1 IWG Meeting)
**—Dennis Hartmann**

The Atmospheres Panel met in two half-day sessions to consider the data products list. In the first of these sessions, data products were discussed by category. During the second session, each instrument team was invited to discuss changes to the data product list for its particular instrument. We attempted to limit inclusion of data products to those that satisfy the following criteria:

1. Data products on the list should be ready for production and distribution at launch.

2. Data products on the list should include level 1 or 2, and not level 3 or 4 products, although level-3 and -4 products must be accommodated by the data system at a later date, and probably will be requested more often by the user community.

Because of limited time, it was not possible to have a thorough discussion of every variable that was proposed to be added. A continuing review of the data products list will be necessary, since some existing products may not continue to stand a rigorous cost/benefit analysis under pressure of limited funding, and other new data products will be developed for which there will be a strong demand.

Several subsidiary issues arose during the discussion.

1. For some of the data products on the list, it is unclear whether the datum is more sensitive to the modeling assumptions involved than to the observables. Longwave radiation at the ground was felt to be in this category by some of the panel members.

2. In some cases, the same variable is measured by more than one instrument, which gives the appearance of redundancy. In most cases each instrument provides some unique quality of measurement, so that the instruments provide more synergy than redundancy. This is the case with many cloud measurements and some constituent measurements. In other cases, data products are offered which are not central to the mission of the instrument in question and which may be of inferior quality to the same product from another instrument. On the other hand, the two instruments may not always be operating simultaneously because of the staggered launch schedule. The quality and utility of secondary measurements and their need to be routinely processed and archived will need continuing evaluation.

On the afternoon of March 30,1993, the Atmospheres Panel met to consider data products by category. The following is a list of major categories of data products and the instruments that contribute to them:

Cloud Products:

- AIRS/AMSU/MHS: High spectral and vertical resolution, consistency with temperature and humidity profiles

- ASTER: High spatial resolution (~30 meters)

- CERES: Broadband energy measurement
- EOSP: Polarization information, high sensitivity to cloud-top particle phase and size
- GLAS: Multi-layer cloud structure information and highly accurate cloud top height
- MIMR: Microwave inference of cloud liquid water column below ice cloud
- MISR: Angular dependence of reflected solar radiation and high spatial resolution
- MODIS: High spectral and spatial resolution (will be on both AM and PM platforms)
- SAGE-III: High vertical resolution and sensitivity to thin clouds

Non-Cloud Aerosol:

- ASTER: High spatial resolution
- EOSP: Has polarization information
- GLAS: High vertical resolution
- HIRDLS: Detects stratospheric aerosols
- MISR: Multi-angle view
- MODIS: High spatial and spectral resolution
- SAGE-III: High sensitivity and calibration quality for stratospheric aerosols

Temperature and Humidity Profiles:

- AIRS/AMSU/MHS: Primary instrument for troposphere
- HIRDLS: High vertical and horizontal resolution in stratosphere
- MIMR: Microwave surface temperature and column water vapor
- MLS: Temperature and humidity in the presence of stratospheric aerosols
- MODIS: Has HIRS capability and can provide coincident temperature and humidity profiles for other instruments on platform when AIRS+ is not present.*
- SAGE-III: Very accurate calibration, high vertical resolution
- TES: Temperature is a secondary measurement

Chemical Composition:

- AIRS/AMSU/MHS: Secondary measurements of $O_3$, $CH_4$, and CO
- HIRDLS: High spatial resolution of source gases and quasi-conserved species
- MLS: Stratospheric constituents, e.g., ClO
- MOPITT: Tropospheric CO and $CH_4$
- SAGE-III: Highly accurate calibration, high vertical resolution
- TES: Tropospheric constituent measurements

Energy Fluxes

- ACRIM: Solar constant
- CERES: Broadband reflected solar and emitted terrestrial radiation
- SOLSTICE: UV spectrum of sun

Surface Winds:

- MIMR: scalar wind stress
- NSCAT: wind stress vectors

Precipitation:

- MIMR (possibly in combination with other instruments, e.g., MODIS)

Lightning:

- LIS

During the morning of April 1, 1993, the data products relevant to the atmosphere from the list of each of the instruments were discussed in turn. Mostly, this discussion resulted in the addition of data products to the "Asrar plus list." Many constituents were added to the lists for the constituent-measuring instruments. In general, these constituent measurements are useful, and the effort required to process and store them is not enormous. Additions also were made to the data products lists for the higher data rate instruments, e.g., MODIS and AIRS+.

* AIRS+ is "shorthand" for the AIRS/AMSU/MHS combination

The high-volume level-2 data sets will need to be monitored to see if they will be used. A summary of the changes to the "Asrar plus list," by instrument, is provided below.

- TES
  - delete $SO_2$
  - add $N_2O$
  - add $HNO_3$
  - restore surface brightness temperature*
  - change vertical range to 0-33 km, all profiles

* Needs an evaluation of the volume/cost relative to the scientific priority/utility.

- MLS
  - add OH ($HO_2$)*
  - add HCl (HOCl)
  - add $HNO_3$ (NO)
  - add CO
  - add geopotential height

* Depends on whether the OH module is included as part of the instrument or not.

- HIRDLS
  - add $NO_2$
  - add $N_2O_5$
  - add $HNO_3$
  - add $ClONO_2$
  - add geopotential height
  - add aerosol extinction coefficient
  - add PSC location and altitude
  - add cloud top pressure
  - add balanced (or geostrophic) wind velocity (level 4)

- SAGE-III
  - add $NO_2$
  - add $O_2$ (pressure, temp)
  - add cloud top height
  - add OClO
  - add $NO_3$
  - add temperature

- MOPITT
  - change spatial, temporal resolution: $CH_4$, CO

- SOLSTICE
  - add Stellar UV Irrad (calibration product)
  - add Solar UV Irrad with 0.001 nm resolution*

* contingent on high-resolution instrument capability

- MODIS
  - add low-level static stability product
  - add precipitable $H_2O$
  - for other instruments:*
    - $O_3$ (ASTER, MISR)
  - temp, moisture profiles (HIRDLS, MISR, MOPITT)

* It was proposed that for use by other instruments and for scientific investigations, MODIS should consider routinely producing column ozone and temperature and humidity profiles using the HIRS-like channels. A more-detailed cost/benefit analysis of this is needed.

- ACRIM (no change)

- MISR
  - delete all level 2, 240-m products
  - delete surface topograph/elevation as a standard product
  - tentative: aerosol size distribution, single-scattering albedo, phase function (over land)
  - change spatial resolution: planetary TOA albedo
  - add reflecting-layer albedo
  - change "BRDF" to "Bi-directional Reflectance Factor," since the full geometry of the BRDF will not be observed directly.

- ASTER (only cloud products considered)

  ASTER cloud products are a valuable scientific product in themselves and a validation product for other cloud instruments, but ASTER cannot sample the entire globe frequently enough to define a climatology of clouds or their effects. Therefore, a sampling and analysis strategy should be developed which allows for the optimum use of the ASTER cloud products in conjunction with other instruments, but which does not attempt to process every ASTER image for cloud variables.

  standard products (priority 2) or special products, add:
  - cloud fractional area (cloud mask)
  - cloud emissivity
  - cloud particle effective radius
  - cloud base height
  - cloud optical thickness
  - cloud liquid water content
  - cloud 3-D structure
  - aerosol optical depth

- GLAS
  change cloud height from top only to multiple layers
  add aerosol scattering vertical structure

- CERES
  add TOA fluxes derived using ERBE algorithms (for trends)

  (There was much discussion about the amount of model dependence of the surface longwave and internal radiative flux divergence products. Should these be level-4 products?)

  CERES cloud products are based on MODIS (or on TRMM, VIRS). Some coordination between MODIS and CERES teams is necessary to produce consistent cloud products, or better, a single cloud data set.

- EOSP
  # 2297 Aerosol optical depth. Accuracy column should be Abs::Rel 0.05 10%
  # 3644 BRDF- not promised at launch

- AIRS/AMSU/MHS
  add fractional cloud cover (effective cloud opacity)
  add cloud IR spectral emissivity*
  add $O_3$ concentration (4 vertical segments)*
  add longwave spectral flux TOA (software)*

  Products, based on microwave measurements that may be required for continuity with NOAA plans. (Needs assessment and coordination with NOAA.)

  cloud ice index

  cloud liquid water

  ice sheet cover index

  snow cover index

  sea ice cover

* Need to assess whether the expected use of these products will be widespread and frequent enough to justify provision on a continuous basis.

- MIMR (little discussion; support current products list)

- NSCAT (little discussion; support current products list)

- LIS (little discussion; support current products list)

## CONGRESSIONAL HEARING

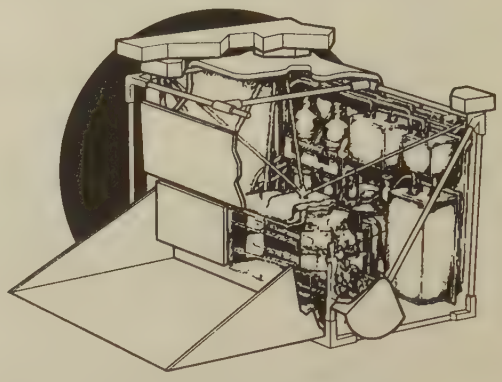
*From EOS.NEWS—June 14, 1993*

On May 19, the House Committee on Science, Space, and Technology held a hearing on Global Change Research: Science and Policy. Four witnesses from academia and the private sector testified before the Committee by stating that the current U. S. Global Change Research Program (USGCRP) is a good long-term basic research program, but it will not provide the policy-relevant answers to the key global change issues. There is a need for an active dialogue between natural and social scientists to identify the best strategy for addressing this shortcoming. Some members of the Committee stated that we must have a sound scientific basis for establishing policy decisions, and we cannot afford to make any mistakes. The common concern was that the answers are needed today, not 10-20 years from now. The general conclusion by the witnesses was that there is a need for an end-to-end assessment, which should be conducted by the experts who reside within the social science community. The concern is that there are no funds currently identified for this purpose, and there were some suggestions by the witnesses that a certain percentage of the USGCRP budget should be set aside for this purpose. There will be a hearing on this subject later on, and the Federal agency members of USGCRP will be invited to participate and to describe their plans for addressing the issue of integrated assessment in the context of their research program. In the meantime, the Committee on Earth and Environmental Sciences has formed its coordinating office in Washington, DC, which will be addressing this and other similar issues.

Science Team Meetings

# Atmospheric Infrared Sounder (AIRS)

—**Hartmut H. Aumann**, Jet Propulsion Laboratory

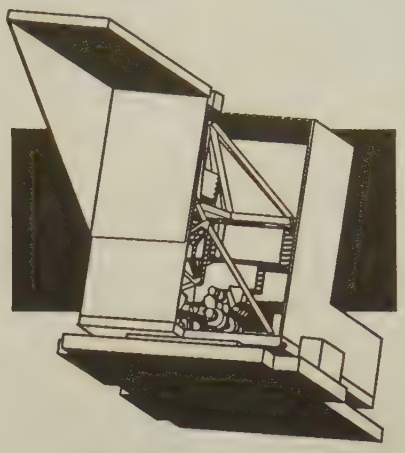


The AIRS Science Team had a very successful meeting May 25-27, 1992 in the World Weather Building in Camp Springs, MD. The meeting included an update by the team leader, Moustafa Chahine (JPL), on the political and personnel situation at NASA HQ, and on EOS and the funding situation. The AIRS hardware status, presented by the AIRS Project Manager, Fred O'Callaghan (JPL) and Avi Karnik (JPL), indicated excellent progress towards the first major milestone, the System Design Review (SDR), at LORAL/LIRIS in Lexington, Mass., the week of September 21, 1993. The status of the data system was presented by Dennis Elliott (JPL) and Barbara Weymann (JPL).

Most of the team meeting was dedicated to progress reports from individual team members concerning the simulation of data, the retrieval of temperature and humidity profiles from the simulated data, and the evaluation of the quality of the retrievals. The simulated data were generated from two satellite passes over the North American continent in January, based on a GCM simulation produced by NOAA/NMC. Compared to previous simulations, that assumed unit emissivity, zero reflectivity, and night time observation, the new simulation included additional complexities: wavelength-dependent surface emissivity, bi-directional reflectance, and daytime conditions. Retrieval algorithm results were presented by Alain Chedin (Ecole Polytechnique, France, neural network retrieval), Mitch Goldberg (NOAA/NESDIS, statistical physical retrieval), Bill Smith/Allen Huang (U. Wisconsin, simultaneous retrieval), and Joel Susskind/Joann Joiner (NASA/GSFC, physical relaxation retrieval). All retrieval algorithms showed excellent progress. The Susskind/Joiner algorithm performed particularly well, given the increased complexity of the data, and met the AIRS retrieval accuracy requirement of one degree rms in a 1 km thick layer in the troposphere.

Considerable discussion involved the next increase in the complexity of the simulation—the addition of clouds. The clouds will be do simulated by the GCM. The cloud properties algorithms for the infrared will be provided by Steve Ackermann and Bill Smith (U. Wisconsin) and for the microwave by Phil Rosenkranz (MIT). Cloud structure within the AIRS FOV will be provided by Catherine Gautier (UCSB). Simulated data including clouds, but with no retrievals, will be available for review by the time of the next team meeting, October 5-7, 1993 at the University of Wisconsin. ▩

# Tropospheric Emission Spectrometer (TES)



—**Reinhard Beer**, Jet Propulsion Laboratory

*The 7th TES/AES Science Team meeting was held at the NASA Langley Research Center on May 4, 5, & 6 1993. All co-investigators were present or represented as were several members of the engineering and software development teams. In addition, representatives came from NASA HQ, the Goddard Space Flight Center EOS Project Office, and the EPA.*

**Data Analysis Working Group [DAWG] (May 4)**

The DAWG meeting (chaired by Curt Rinsland, of NASA Langley Research Center) occupied the first day.

Tony Clough, AER, Inc., showed an update of his tropospheric ozone retrieval studies. He demonstrated that, provided that other parameters such as temperature, humidity, and the stratospheric ozone are known perfectly, a 3-layer retrieval can be achieved in the troposphere with about ±4 ppb precision (continental clean air typically has 10 - 30 ppb). The next stage will be to investigate the effects of the inevitable uncertainties in these other parameters.

Helen Worden, JPL, described the progress on the level 1B algorithm (interferograms -> calibrated spectra). This code is close to being operational for AES and forms the prototype for TES.

Reinhard Beer, JPL, presented a proposed set of levels -1A, -1B, and -2 input-output requirements for AES and TES Special Processing. Several suggested additions made by the team have been incorporated.

Larry Sparks, JPL, discussed the status of the parallelizable retrieval algorithm SEASCRAPE. The code is sufficiently advanced that some "third party" testing has begun.

Hank Reichle, NASA Langley Research Center, described the cloud-clearing technique using the known $N_2O$ column density that has been applied to the MAPS data with conspicuous success. TES and AES may employ a similar approach.

Tony Clough has generated an improved set of water vapor continuum coefficients that are a much better fit to field data in certain critical regions. These coefficients are being incorporated into all our simulation and retrieval codes. He also pointed out that self-broadening is a non-negligible effect in the water vapor spectrum (it usually is ignored).

Aaron Goldman, U. Denver, then showed the effects of his recent laboratory studies on the retrieval of atmospheric $HNO_3$ concentrations.

The rest of the day was given over to the intercomparison of 5 forward models in the critical ozone region around 1040 $cm^{-1}$. The models intercompared were LBLRTM (AER Inc.), GENLIN2 (Oxford U.), ES (JPL), SEASCRAPE (JPL) and a U. Denver code. All codes used a previously agreed-upon physical and chemical model atmosphere and, therefore, should have produced identical results. As is usual in such trials, discrepancies of a few percent were observed among all of them. After much discussion, it was agreed that a likely significant cause was the range over which the instrumental (sinc) function was defined in each of the codes. It was decided i) to repeat the test using a stronger Norton-Beer apodization, which converges much faster than sinc, and to make some other minor changes in the prescription; and ii) to eliminate ES and the Denver code from further consideration since neither is incorporated into retrieval

codes. The results will be reported at the next team meeting.

It also was agreed upon that the next level of intercomparison should be on the partial derivatives that are an essential element of all modern retrieval algorithms. However, some codes generate these parameters by finite differences and some analytically, so this will be a critical test for all candidates for our operational algorithm. The plan is to complete this trial by the fall of this year.

**Plenary Session I (May 5; morning)**

Following introductory remarks by Reinhard Beer, Joe McNeal, NASA HQ, gave an overview of the EOS program status. Included was a discussion of the possibility that TES might be moved forward from AM2 to the CHEM platform. The impact of such a move on both TES and the CHEM platform is currently being investigated in preparation for the next Payload Panel meeting.

Reinhard Beer then gave a report on the recent IWG, where the principal topic was the Standard Products from each instrument. For TES, the current list being carried by the Program Office does not reflect the team's wishes, so a revised set was presented to the Atmospheres Panel and, with two exceptions, was endorsed and carried forward to the Program Office. One of the exceptions—a flag to indicate the signatures of unexpected species in the spectra—was proposed by Ghassem Asrar to be moved into the metadata. The team has no objection to this. The other exception was a query from the Atmospheres Panel chairman, Dennis Hartmann, as to the need for the retrieval of surface brightness temperature. The team requested that a letter be written emphasizing the critical nature of this parameter for determining the radiometric contrast between surface and atmosphere, and therefore the detection sensitivity for all species.

Jack Fishman, NASA Langley Research Center, gave an update on his studies of global tropospheric ozone, using TOMS-SAGE differences. Prior to TES, this is the only known method for deriving this parameter, which is vital for investigating the oxidizing power of the lower atmosphere. Some of the pitfalls of the approach were described (an important one being the method TOMS uses to extrapolate total ozone over the cloudy tropical regions), and some preliminary results on attempts to produce ozone maps covering much shorter time scales than previously were presented.

The remainder of Session I was occupied with a presentation on the Langley DAAC, where TES data will be processed and archived, followed by an actual demonstration at the DAAC itself. The team members were very impressed with what they heard and saw and expressed thanks to Bob Seals and his colleagues for an excellent effort. After returning to JPL, some team members successfully logged on to the DAAC using a prescription provided at the meeting.

**Plenary Session II (May 5; afternoon)**

The second session began with Tom Glavich, JPL, giving an overview of the status of both TES and AES projects. For TES, "risk reduction" activities continue in preparation for the CDCR now expected early in 1994. A number of critical elements have been successfully breadboarded and a novel drive mechanism for the interferometer retroreflectors will soon begin life testing over 2 million forward-reverse cycles.

Wally Porter, JPL, discussed the status of the AES instrument. All components are now in-house, and subsystem assembly has begun. Testing and calibration will begin this summer, preparatory to the first test flight in April 1994. The program continues on schedule and within the (fixed) budget.

Reinhard Beer presented the overall AES Mission Plan (basically, the mix of filters to be used for each type of observation and the data volumes resulting). The team endorsed the approach and agreed that a sub-group should be convened to generate a flight plan for the first scientific use of AES.

Rich Cageao, JPL, described the AES pre-flight calibration plan. The facility for performing this operation at JPL is essentially complete.

Finally, Tom Glavich gave an update on the on-going discussions with Oxford University concerning their proposed provision of TES pre-flight and in-flight calibration. A meeting was held at Oxford in April (attended by Reinhard Beer and Tom Glavich, together with four representatives of the AIRS project—Fred O'Callaghan, Avinash Karnik, Ron Ross, and Rudy Schindler). Remaining issues are the means by which we obtain approval both within the U.S. and the U.K. and some minor logistic considerations.

**Plenary Session III (May 6; morning)**

The final session began with a presentation by Hank Reichle on his studies of tropospheric CO using the Shuttle-based MAPS instrument. MAPS is due to fly twice more within the next year or so, and will provide a valuable update on the changes in the global distribution of CO since the last flight nearly a decade ago. He also outlined the plans for the AM1 MOPITT instrument, which has similar goals to MAPS (but, of course, over a much longer time span).

Following this presentation, Steve Larson, JPL, provided an overview of the character of the AES data catalog and the means by which investigators can access the archive and request products (basically, for non-JPL users, this will be by delivery of 8 mm tapes in UNIX tar format). Potential users are invited to contact Reinhard Beer at (818) 354-4748 or by e-mail at beer@atmosmips.jpl.nasa.gov for further information. It also was agreed that we should investigate the possibility of submitting level-1B & -2 products to the Langley DAAC.

The next Science Team meeting will be held at JPL on October 5, 6, & 7 1993.

## ADEOS ANNOUNCEMENT OF OPPORTUNITY

The National Space Development Agency (NASDA) of Japan issued the first research opportunity announcement for the Advanced Earth Observing System (ADEOS) on July 1. Letters of intent were due by the end of July and proposals are due by the end of October. The announcement covers all of the instruments selected for launch on ADEOS in February 1996, including OCTS, AVNIR, IMG, ILAS, RIS, TOMS, NSCAT, and POLDER. Additional details will be made available through EOS.News as soon as they are released by NASDA.

## EOS Science Calendar Point of Contact

Beginning July 1, 1993, Sarah A. Wager at Jorge (pronounced George) Science Corporation will be assisting Michael King, EOS Senior Project Scientist, to distribute the EOS Science Calendar of Instrument Team meetings. The calendar will continue to be distributed on the first of each month or whenever changes in the schedule occur. Meeting inputs are due to Wager two days prior to the first of each month. Meeting additions or changes should be senior t via e-mail to swager@gsfcmail.nasa.gov, or by fax to (301) 220-1704. Please include the following information for each meeting: Instrument Team, name of the Principal Investigator/Team Leader, meeting dates, meeting location, point of contact/telephone number, and comments.

## HONORS—GEOPHYSICISTS

Shelby Tilford, acting associate administrator for NASA's Mission to Planet Earth, received the William T. Pecora Award on May 26. The award is given jointly by NASA and the Department of the Interior in memory of William T. Pecora, former director of the U.S. Geological Survey and Under Secretary of the Department of the Interior. Tilford was honored for his work in promoting the use of satellites for Earth observations. He has played a pivotal role in the planning and implementation of the Earth Observing System and has been instrumental in the formation of the multi-agency U.S. Global Change Research Program.

# The Earth Observations International Coordination Working Group (EO-ICWG)

— **Lisa Shaffer**, NASA Headquarters

The Earth Observations International Coordination Working Group (EO-ICWG) held its 19th meeting in Paris at ESA Headquarters on April 26-27, 1993, followed by the second meeting on the Implementation Plan for the International Earth Observing System (IEOS). Representatives from all the EO-ICWG participating agencies were present. The EO-ICWG is the forum in which the NASA EOS program and its international counterpart programs (ESA's POEM, NOAA's POES series, NASDA's ADEOS, and the joint NASA-NASDA TRMM) are coordinated. The topics for discussion included status updates on each program, special presentations on the associated data systems, the data exchange principles nearing agreement for IEOS, and longer-term payload scenarios for post-2000 missions.

ESA is finalizing the funding arrangements for the first POEM mission, called ENVISAT, scheduled for launch in 1998. The Phase B study of the ENVISAT-1 ground segment is underway and should be completed in September. A "Preparatory Phase" program is underway regarding the second POEM launch, METOP, which will be implemented by ESA and EUMETSAT, and will carry an operational meteorological payload along with climate monitoring instruments.

NASDA's ADEOS program is on track for launch in February 1996, carrying the NASA Scatterometer and TOMS instruments along with the French POLDER and Japanese ocean color (OCTS), high-resolution imaging (AVNIR), greenhouse gas (IMG), stratospheric chemistry (ILAS) instruments, and a retroreflector (RIS). The TRMM mission is in Phase C, with full backing of the Japanese Government, and is scheduled for launch in 1997.

The IEOS Implementation Plan was the subject of lengthy discussions. A tiger team was formed to complete the first draft for further review in September among all the participants. This plan addresses the interconnection of the data systems supporting EOS, ENVISAT, ADEOS, TRMM, and NOAA POES, and will also include METOP and related data systems of other agencies in EO-ICWG such as the Canadian Space Agency and MITI. Agencies are creating an integrated schedule and milestones for interoperability, while addressing those tasks that the CEOS Working Group on Data (WGD) should be asked to support and those to be done by the IEOS agencies directly. A letter was sent to the Committee on Earth Observation Satellites (CEOS) WGD asking for their input on certain key areas such as catalog interoperability, data formats, networks, and browse. The idea is to take advantage of the broader CEOS forum to develop recommendations on common compatible approaches for data systems where possible, recognizing that the IEOS agencies are all important participants in the CEOS WGD. No agency wants the approaches to be developed for IEOS to differ from the CEOS approach, but some effort is needed to ensure that time schedules are compatible with IEOS development and decision requirements.

The EO-ICWG process is an ongoing activity, enabling informal, frequent exchanges of information and negotiation of key issues among the IEOS agencies. The next meeting is scheduled for Montreal in early November. The IEOS Implementation Plan will be the subject of a special meeting in late September hosted by NASA at GSFC. NASA participants in the Paris meetings were Lisa Shaffer, Alex Tuyahov, and John Gainsborough from NASA Headquarters, Code Y; Lynn Cline from NASA Headquarters, Code IR; and Matt Schwaller from GSFC. Further information is available from them. ▩

# Interdisciplinary Field Experiment Data Released on CD-ROM

—**Gary Angelici** and **Lidia Popovici** (Sterling Software) and **Jay Skiles** (Johnson Controls World Services)
NASA Ames Research Center

The first of a set of five CD-ROMs of data collected by the OTTER (Oregon Transect Ecosystem Research) project has been completed. The disc contains a coordinated set of satellite, aircraft, field, and laboratory measurements that were gathered during data collection campaigns and applied in the ecosystem research and modeling studies of the OTTER project investigators.

**The OTTER Project**

The OTTER project had the principal objective of estimating major fluxes of carbon, nitrogen, and water through forest ecosystems using remotely sensed image data. More than 20 scientists from over 10 research institutions across the United States and Canada participated in the testing and validation of the predicted fluxes and their biological regulation as simulated by ecosystem process models. Most data were collected in 1990 at six separate sites along an elevational and climatic gradient in west central Oregon to coincide with pre-budbreak (March), maximum growth (June), water stress (August), and senescence (October.) Additional data were collected in the spring of 1991.

The bulk of the data collected for the OTTER sites consisted of remotely sensed imagery from instruments flown on satellites and on high-altitude and medium-level aircraft, such as NASA's ER-2, C-130, and DC-8. In addition, light and ultralight aircraft returned spatial, spectral, and video data. Satellite images for the project were registered composite AVHRR (Advanced Very High Resolution Radiometer) data generated by the EROS Data Center. The hundreds of aircraft flight lines and scenes collected included data from the ASAS (Advanced Solid-state Array Spectroradiometer), AVIRIS (Airborne Visible/InfraRed Imaging Spectrometer), Dædalus TMS (Thematic Mapper Simulator), NS001 TMS, and TIMS (Thermal Infrared Multispectral Scanner) instruments.

OTTER investigators used a variey of spectroradiometers to collect spectral reflectance measurements as ground truth for remotely sensed data. Other ground data collected include base station meteorological, soils, field sunphotometer, and ceptometer data. Data produced in the laboratory included various biochemical, biophysical, physiological, and nutrient cycling measurements. Results from several simulation runs of a forest ecosytem model were retained, as well as data derived from mathematical calculations on raw data and from combinations of bands of raw data, such as leaf area index (LAI). The data sets collected for the entire project total nearly 16 gigabytes.

**CD-ROM Contents**

The first OTTER CD-ROM contains both image and tabular data for the following data sets, with the number of scenes (for image data) in parentheses:

Image
- ASAS (2 scenes, 7 tilt angles each)
- AVHRR (12 scenes)
- AVIRIS (1 scene)
- Dædalus TMS (30 scenes)
- Digitized Aerial Photographs (7 color infrared photographs)
- NS001 TMS (14 scenes)
- TIMS (16 scenes)

Tabular
- Airborne Sunphotometer
- Canopy Chemistry
- Field Sunphotometer
- Meteorology
- Timber Measurements

The image data collected from the C-130 aircraft (ASAS, NS001, and TIMS) on this and subsequent CD-ROMs were chosen to correspond to four times during the data collection periods. These times were: 1) high sun, parallel to the plane of the path of the sun; 2) high sun, perpendicular to the plane of the path of the sun; 3) low sun, parallel to the plane of the path of the sun; and 4) low sun, perpendicular to the plane of the path of the sun. First, specific ASAS scenes with specific flight lines were chosen for inclusion on CD-ROM. Then, NS001 TMS and TIMS scenes were chosen so that they would have the same flight lines with the same sun angles.

Data for the aircraft imagery are provided for each of the six sites for

the five data collection periods in 1990 and 1991. The disc contains one geo-registered AVHRR scene covering all sites for each month of 1990.

The OTTER imagery is provided in separate files in byte format for each individual spectral band with no header (except for the AVIRIS and ASAS scenes, which are stored in the format as distributed by the data providers). For example, there are 8 files of imagery for each NS001 TMS flight line, one for each band. In addition to the image files of Dædalus TMS, NS001 TMS, and TIMS, a file of housekeeping information is provided for each band with a summary file of calibration and other ancillary information for each scene.

OTTER tabular files of field and laboratory data, stored in ASCII format and containing mainly numerical data, were prepared for easy input into spreadsheet and database programs. The sunphotometer measurements can be used to correct the image data for atmospheric effects. The base station meteorological data, collected continually from 1989 to 1991, contain hourly measurements and daily summaries. Concentrations of several chemicals, such as sugar and starch, are given for several species on selected data collection days (during periods of aircraft overflights) for all sites. The data for one site, in which a portion was fertilized, are summarized over a monthly period in another file of chemistry data.

The data files on the CD-ROM follow many of the conventions and structures developed by NASA's Planetary Data System (PDS). Each data file is accompanied by a descriptive PDS label file, which, in the case of image data, permits easy display on personal computer systems. The public domain software package, "Imdisp," is provided on the disc for image display on IBM personal computers (and compatible machines). The popular shareware program, "Stuffit," is necessary to extract the execution file for the Macintosh display program, "Image4PDS." All imagery, except for AVIRIS and ASAS data, can be displayed using the software on the disc. Complete documentation on PDS file formats as they relate to the OTTER data is provided on the disc. General project documents on the CD-ROM describe the OTTER project, the precise location of the sites, the data collection campaigns, and each of the instruments/data sets. The disc includes files offering assistance in using the disc, such as a file describing the disc-file-naming conventions and an image index listing image files on the CD-ROM according to site, date, and data set name. The provision of image coordinates of the OTTER sites in the Digitized Aerial Photography images aids in the precise location of the sites in other imagery.

**Conclusion**

As mentioned earlier, this is the first of a set of five CD-ROMs. The remaining four CD-ROMs are scheduled to include the following data sets:

- Airborne SAR (Synthetic Aperture Radar)
- ASAS
- AVIRIS
- CASI (Compact Airborne Spectrographic Imager)
- Field Spectrometer Measurements
- Soils Data
- Ultralight Video and Spectral Measurements

Once again, the imagery selected for these discs will conform to the rules adopted for the first disc. Sampler images from the large format instruments, such as Airborne SAR, ASAS, AVIRIS, and CASI will be generated to enable easy display of selected bands. The remaining discs are scheduled to be available in late 1993.

It is anticipated that the coordinated data sets on these discs will be useful for studies of seasonal forest ecosystem dynamics, in studies of carbon and water fluxes in temperate coniferous forests, and in the application of remote sensing technology to help answer ecological questions. While a number of analyses of these data are to be published in special issues of two journals, the data constitute a valuable baseline for future studies of forest ecosystems.

PLDS (Pilot Land Data System) staff members at the Ames Research Center, under sponsorship of the Ecosystem Dynamics and Biogeochemical Cycling Branch of NASA's Earth System and Applications Division, produced the disc as one of the services of the ongoing support of the OTTER project. The PLDS staff prepared the data, documentation, and all supporting files for publication, and premastered the disc on the PLDS/Ames Sun server using Makedisc premastering software.

Figures on page 21 show four images extracted from those on OTTER CD-ROM #1.

For further information, contact Gary Angelici and Jay Skiles at the Ames Research Center, (415) 604-5947 and (415) 604-3614, or on Internet at gary@pldsa1.arc.nasa.gov and jay@pldsa1.arc.nasa.gov.

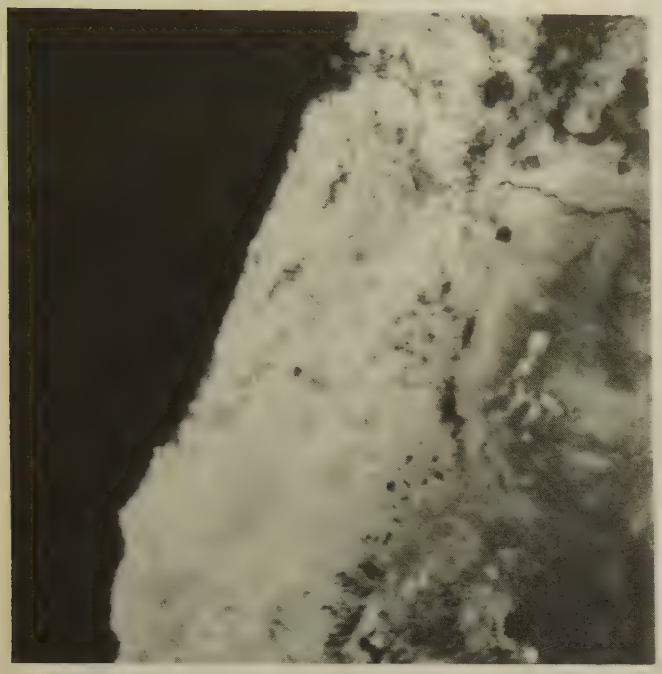


Figure 1a. Band 6 from the AVHRR instrument, taken during June, 1990 over Oregon. Note the Columbia River and the city of Portland, Oregon. The OTTER transect runs west to east, from the coast inland, about one-fifth of the way from the top of the scene.

Figure 1b. Site 1 (Cascade Head) using band 4 from the Daedalus TMS, taken during June, 1990.

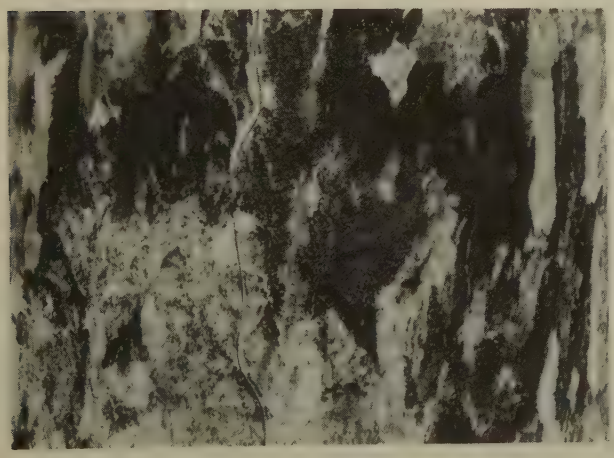


Figure 1c. Site 1, band 4, from the NS001 TMS, taken during June, 1990. (Bands 4 for the two TMS instruments are not equivalent.)

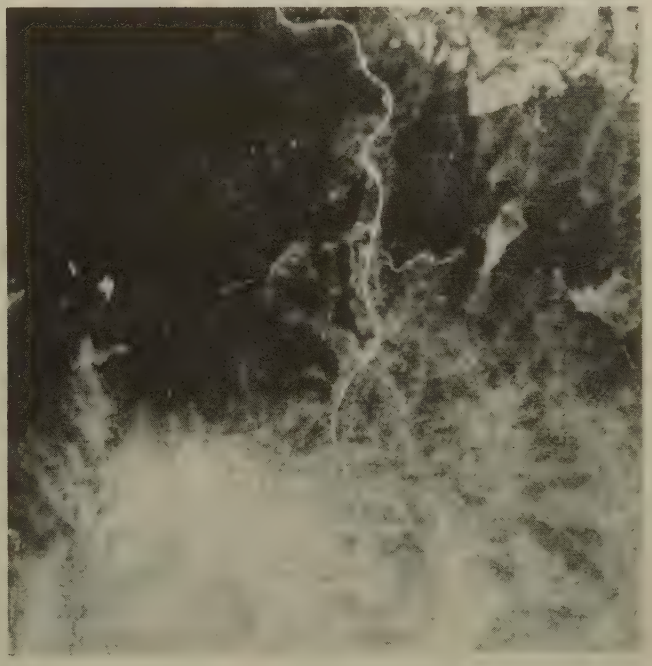


Figure 1d. Scene from the TIMS instrument over Site 1 during June, 1990, using band 6.

# MECCA Identifies Uncertainties in Climate Modeling

—Reprinted from *Earth Quest*, Spring 1993

The validity of computer model predictions of global environmental change, as of anything else, depends on the reliability of the models. Climate modelers have long recognized that uncertainties in the models will create uncertainties in the accuracy of the model predictions.

The Model Evaluation Consortium for Climate Assessment was created in 1991 to address this problem. MECCA has two objectives: to perform experiments that will identify and quantify the uncertainties associated with predictions of greenhouse-gas-induced climate change, and to create a protocol for analyzing the experiment results and applying them to policy. Its creators were mindful of another problem: Most global climate research efforts are on decadal or longer scales, but policy-makers and industrial decision-makers must make decisions more quickly than that. To meet those needs, MECCA was originally set up as a three-year effort, and the initial experiments were completed within a single year.

MECCA is an international consortium with members in academia, industry, and government. Its sponsors are Electricité de France; the Italian Agency for New Technologies, Energy, and Environment (ENEA); the Central Research Institute of Electric Power Industry (Japan); N.V. KEMA (Netherlands); the U.S. Electric Power Research Institute; Southern California Edison; the National Supercomputing Center for Energy and the Environment (NSCEE); and the University Corporation for Atmospheric Research.

The program began by sponsoring 14 experiment teams totaling 24 scientists to study specific uncertainties in modeling ocean and atmospheric dynamics, atmospheric chemistry, and the land surface and terrestrial ecosystems (described below). These experiments were basic studies of a model's sensitivity to various parameters that are important for understanding the present and future climate. To provide the necessary computing power, MECCA sponsored a dedicated CRAY Y-MP supercomputer located at the National Center for Atmospheric Research (NCAR). Additional supercomputer resources have been made available by NSCEE. The first experiments were completed last fall, and a second series has begun, with additional proposals being sought.

To reach its second goal, of presenting scientific results in a form meaningful to decision-makers, these studies are now being examined by the MECCA Analysis Team, led by Ann Henderson-Sellers (Macquarie University, Australia). The analysis team intends to assist the investigators in synthesizing MECCA assessments with results from other international research, and in making sure that experiments and results are answering questions of importance to policy-makers. They are working to develop standard model subcomponents or coupling schemes that can be used by several researchers in different models, allowing model comparisons. Also planned is an effort to identify improvements which could be made in the application models used to infer the impacts of climate change.

With its research and analysis components thus well established, MECCA is looking for ways to make the project even more useful to industrial and political decision-makers. Historically, scientific information has not been effectively shared with this community, and the needs of the decision-makers have reached the scientific community in an equally inefficient fashion. MECCA hopes to develop methods to speed and strengthen the interface, for example, by soliciting the information needs of businesses in such fields as energy, agriculture, or insurance and designing research that will answer those needs.

**MECCA Initial Findings**

MECCA data already were incorporated into the 1992 science update of the Intergovernmental Panel on Climate Change. Interim results from MECCA enjoy a high level of scientific credibility, with early findings including the following:

- Although the Earth grows warmer as atmospheric levels of carbon dioxide increase, the rate of warming drops off as more $CO_2$

is added. The effect appears to be the result of saturation of the model's water vapor absorption bands. The finding (by Barry Saltzman, Yale University; Robert J. Oglesy, Purdue University; and Susan Marshall, Colorado State University) has important implications for creating policy for acceptable levels of $CO_2$.

- A doubling of atmospheric $CO_2$ is widely used by modelers to stand in for the predicted increases in all greenhouse gases, which include methane, nitrous oxide, and the chlorofluorocarbons. Wei-Chyung Wang (State University of New York, Albany) found, however, that when changes in the other greenhouse gases are explicitly modeled over continental regions, there is a considerable difference in the predicted warming patterns. In the Northern Hemisphere, the other gases may increase the predicted warming by 20%; in the Southern Hemisphere, warming could actually decrease by 10%. The effect varies with altitude.

- Tropical forests play an integral role in the balance of the Earth system. An experiment by A. Henderson-Sellers, T.B. Durbidge, A.J. Pitman (all of Macquarie University), and K. McGuffie (University of Technology, Sydney, Australia) studied the effects of replacing a forest in the Amazon with scrub grassland. They found that while temperature increases were less than most previous experiments had predicted, there were greater changes in evaporation and precipitation. Another experiment found smaller but consistent responses when the deforestation was modeled in southeastern Asia.

- Studies using a regional-scale model "nested" in (interfaced with) a general circulation model (GCM) indicate that the ability to model regional-scale effects is critical for understanding greenhouse gases. In two simulations of 3.5 years of climate in several U.S. regions, one using a nested model and one a GCM alone, the additional topographic features of the nested model gave better simulations of both temperature and precipitation. The experiment was done by Filippo Giorgi (NCAR), Guido Visconti (University of L'Aquila, Italy), Rosaria Marinucci (NCAR), and Gerardo De Canio (ENEA).

The other initial studies were:

- Climate sensitivity experiments with improved GCMs (Warren Washington and Gerald Meehl, NCAR)

- Effects on tropical rainfall of anomalous sea surface temperatures (T.N. Krishnamurti, Florida State University)

- Sensitivity of the coupled Mediterranean-North Atlantic Ocean circulation to atmospheric forcing (William Holland, NCAR; Nadia Pinardi and Vincenzo Artale, ENEA)

- GCM sensitivity to different polar ice simulations (Starley Thompson, David Pollard, and Jon Bergengren, NCAR)

- Internal model variability over very long term (400-year) simulations (Edwin K. Schneider and James L. Kinter III, University of Maryland)

- Sensitivity of cloud parameterization schemes to $CO_2$ in the Voeikov Main Geophysical Observatory (MGO) model, Russia (Valentin Meleshko, MGO)

- Climate model sensitivity to grid resolution (Dave Williamson, NCAR)

- Mass flux sensitivity in the model of the Bureau of Meteorology Research Centre (BMRC), Australia (Bryant McAvaney, BMRC)

- Sensitivity of ocean circulation to different prescriptions of wind stress forcing (Albert Semtner, Naval Postgraduate School, and Robert Chervin, NCAR)

MECCA seeks to make a difference when policy decisions are made about greenhouse gas emissions. Better information about climate simulations will provide policymakers with a better understanding of the risks and benefits of their decisions. But additional financial and in-kind support is needed to complete the three-year research and analysis plan.

For additional information or to discuss collaboration, please contact:

Dennis Kois
MECCA Communications Office
Science & Technology Management, Inc.
2511 N. 124th St., Suite 205
Brookfield, WI 53005
USA
Phone: 1-414-785-5946
Fax: 1-414-785-5950

# Global Change Research in The Arctic: The IASC Global Change Program Office

—**Manfred A. Lange**, Arctic Centre, University of Lapland

The Arctic is known to be a region where the consequences of global environmental changes, notably climate changes, will be particularly severe. The currently existing global climate models all share the common feature of a significantly larger rise in mean surface temperatures at high northern latitudes than elsewhere. This is particularly disturbing since a number of feedback processes involving a shrinking sea ice cover or the release of greenhouse gases from thawing permafrost are believed to enhance any initial warming. This will have a bearing on the rest of the world and underlines the importance of high-latitude processes for the state of the global system.

It is these considerations that have led to a growing awareness that global change research cannot leave out the polar regions. Consequently, the International Geosphere-Biosphere Program (IGBP) through its START-Initiative (SysTem for Analysis, Research and Training) and the World Climate Research Program (WCRP) through its recently launched Arctic Climate SYstem Study (ACSYS) have acknowledged these facts.

Right from the start, the International Arctic Science Committee (IASC) and its member countries recognized the importance of global change research as a major thrust of the newly formed organization. One of the first working groups initiated by IASC was the Global Change Working Group under the chairmanship of Gunter Weller (University of Alaska). During a first workshop in Reykjavik, Iceland in April of 1992, the Working Group outlined the possible scope of an Arctic Global Change Research Program (AGCRP). During the subsequent IASC council meeting, also in Reykjavik, it was felt that some supporting structure was needed in order to get the AGCRP off the ground. Finland offered to host what was to become the IASC Global Change Program Office (IASC-GCPO). During their recent meeting in Abisko, Sweden, the Council decided to accept this offer and to charge the Arctic Centre at the University of Lapland in Rovaniemi, Finland, with the task of implementing the IASC-GCPO. Headed by Manfred Lange, the Office will primarily support and implement the scientific initiatives and decisions of the Global Change Working Group. It will also be a contact point between the Group and other international global change research programs active or with an interest in the Arctic.

By establishing a GCPO, IASC has now forged ahead of its southern counterpart, the Scientific Committee on Antarctic Research (SCAR) which, also under the leadership of Gunter Weller, had earlier worked out a plan for global change research in Antarctica. It is hoped that both initiatives will eventually be merged in the future in order to join forces in what is bound to become a very important component of research on global environmental changes.

For further information please contact the Global Change Program Office at the Arctic Centre, P.O. Box 122, SF-96101, Finland; Phone: +358-60-324-771; FAX: +358-60-324-760. ■

## ERS-1
## Five hundred days in orbit

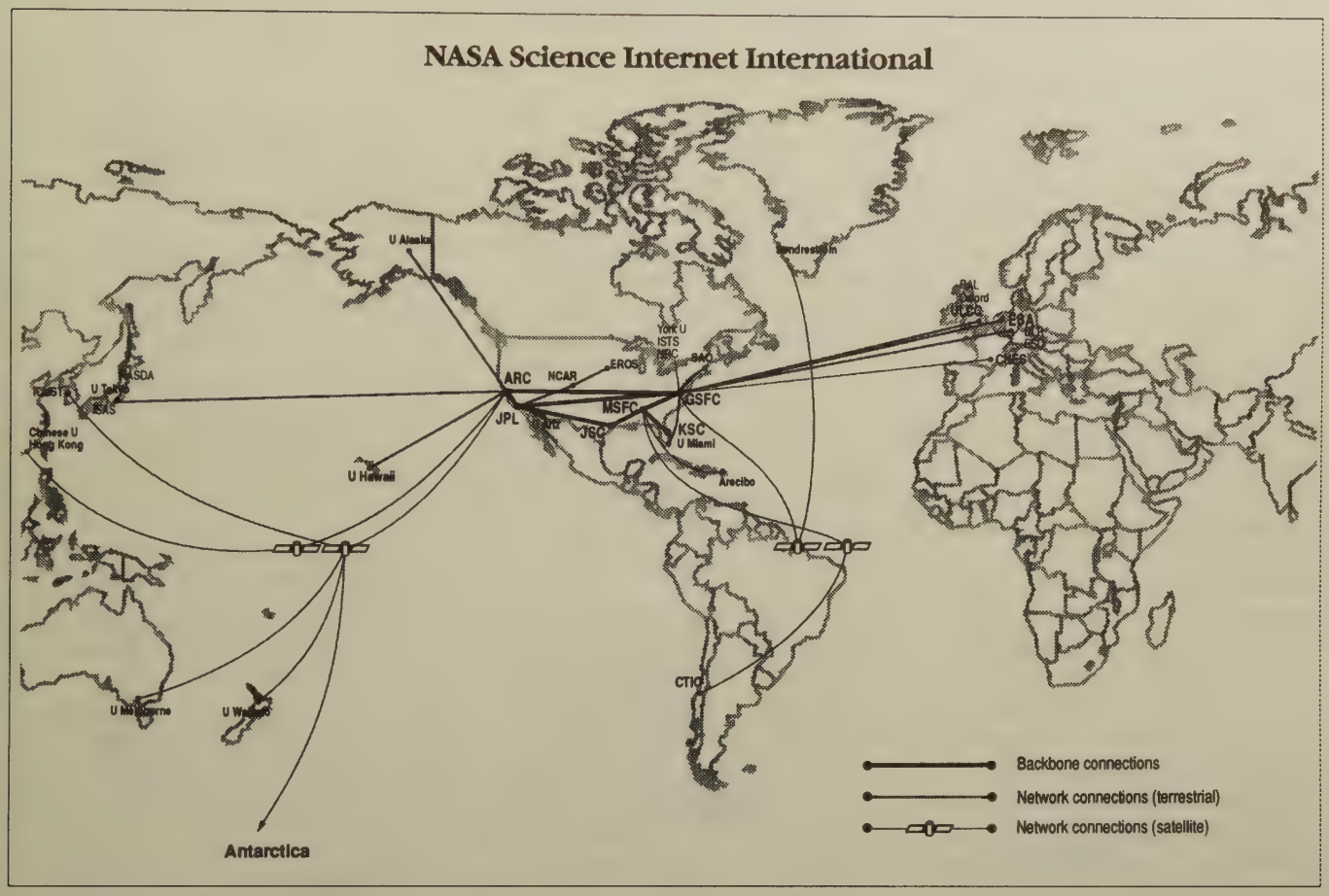
ESA has produced a colorful booklet with the above title, which gives a very nice overview of the various ERS-1 applications. On July 17 it was exactly two years since ERS-1 was launched. The booklet gives examples of SAR images from most European countries (some 24 descriptions of ERS-1 images and results) as well as a more-detailed overview of spacecraft performance, calibration and data delivery. Copies may be obtained from:

European Space Agency
Public Relations Division
8-10, rue Mario Nikis
75015 Paris Cedex 15, France

For inquiries on the availability of ERS-1 data, please contact the ERS-1 Help Desk, ESA/ESRIN, Tel: (39) 6 94180600; Fax: (39) 6 94180351.

# New Network Information Center Supports Advanced Applications

—**Elizabeth Feinler**, NASA Science Internet, Ames Research Center




The new Network Applications and Information Center (NAIC) began operations on March 29 under the Advanced Network Applications (ANA) Section at Ames Research Center. This is the first step in enhancing NASA Science Internet (NSI) network user support by evolving from a single Network Information Center (NIC) toward a coordinated NASA-wide support system of distributed Network Information Center NICs (CNICs). Each CNIC will be colocated with the Center's science users, and thus will be more familiar with those end-user's special environments, applications, and specific network usage problems.

The NAIC expands upon the original successful NSI NIC function provided by Goddard Space Flight Center by merging it with several existing functions at Ames in the ANA Section. This merger enhances the overall NIC service by directly coupling it to advanced applications such as agency and interagency directory services and interoperable e-mail gateway development.

NAIC will provide two basic services in support of the NASA science and research community. First, it will distribute basic user service and

science applications toolkits to the CNICs, and then it will work with the CNICs to plan and coordinate future activities for NASA's "network of NICs." Second, it will provide support for many of the advanced network applications now being developed and deployed by ANA; many of these new applications are driven by NASA science and research programs, but need further adaptation. NAIC will also look outside NASA for relevant tools and applications, leveraging on its involvement with the Internet Engineering Task Force and various international technical groups, as well as drawing upon the commercial marketplace.

Having a network of NICs will directly benefit NASA science network users because their network information services will be located at the same centers as their research laboratories and computer facilities.

End users will find that their information needs can be met by their local CNIC, which best understands their institutional communications and local network needs. In addition, the development of a coordinated set of network tools and applications will make it possible for each CNIC to deliver more information services directly to the scientists' workplace. The scientist no longer needs to learn new procedures to access various network information services at remote locations. With NAIC's generic set of network tools, users and CNICs alike will benefit from dedicated local support, reduced duplication of effort, and improved ability to share resources. This approach embodies NASA's "cheaper, faster, better" paradigm.

When the new CNIC architecture is fully in place, each CNIC expects to handle most end-user questions. This will allow the NAIC at Ames to devote the bulk of its efforts to developing new procedures and guidelines for advanced network applications. The NAIC will also provide scientists with the latest versions, implementations, documentation, and even installation "folklore" for widely supported network applications.

Ames' NAIC is also planning to lead community outreach and seminars to train network users and implementers. ANA and NAIC will work closely with NASA's Inter-Center Council for Computer Networking, NASA wide-area networks, NASA Center communications facilities, the National Science Foundation's new federal InterNIC, and related network information activities in a coordinated effort to meet all the network information and applications needs of NASA science network users.

Currently, ANA is deploying X.500 "White Pages" Directory Services and associated User Agents at all the NASA Centers. This includes ANA support for ISODE, QUIPU, PHBook, FINGER, PCPHBook, and SYBASE database reach-through. ANA also supports various electronic messaging services and online mail distribution services including: CE Quickmail, X.500 Reflector, HQ's NSIRELAY, Lotus cc:Mail, Microsoft Mail for PCs, networked FAX, ZMAIL DEC'S ALL-in-One, ASTROMAIL, AISRP, and HEAD mail. Future plans include development and support for multimedia mail, X.500 "Yellow Pages" Directory Service, online network conferencing, and electronic signature authentication.

Larry Gamble will be heading up the NAIC assisted by April Marine, Mary Stahl, Tony Quartuccio, Alex Deacon, and Mike Armstrong. The author is assisting with NIC architecture and planning. Cyrus Chow leads ANA's research and development activities. Both groups are under NASA Manager John Yin and Sterling Task Manager Laura Stark, and are part of the Ames Wide Area Networks and Services Branch (Code EDC).

For further information contact the NAIC at: (415) 604-0763, Internet: NAIC@nasa.gov; NSI/DECnet: EAST::"naic@nasa.gov" ▩

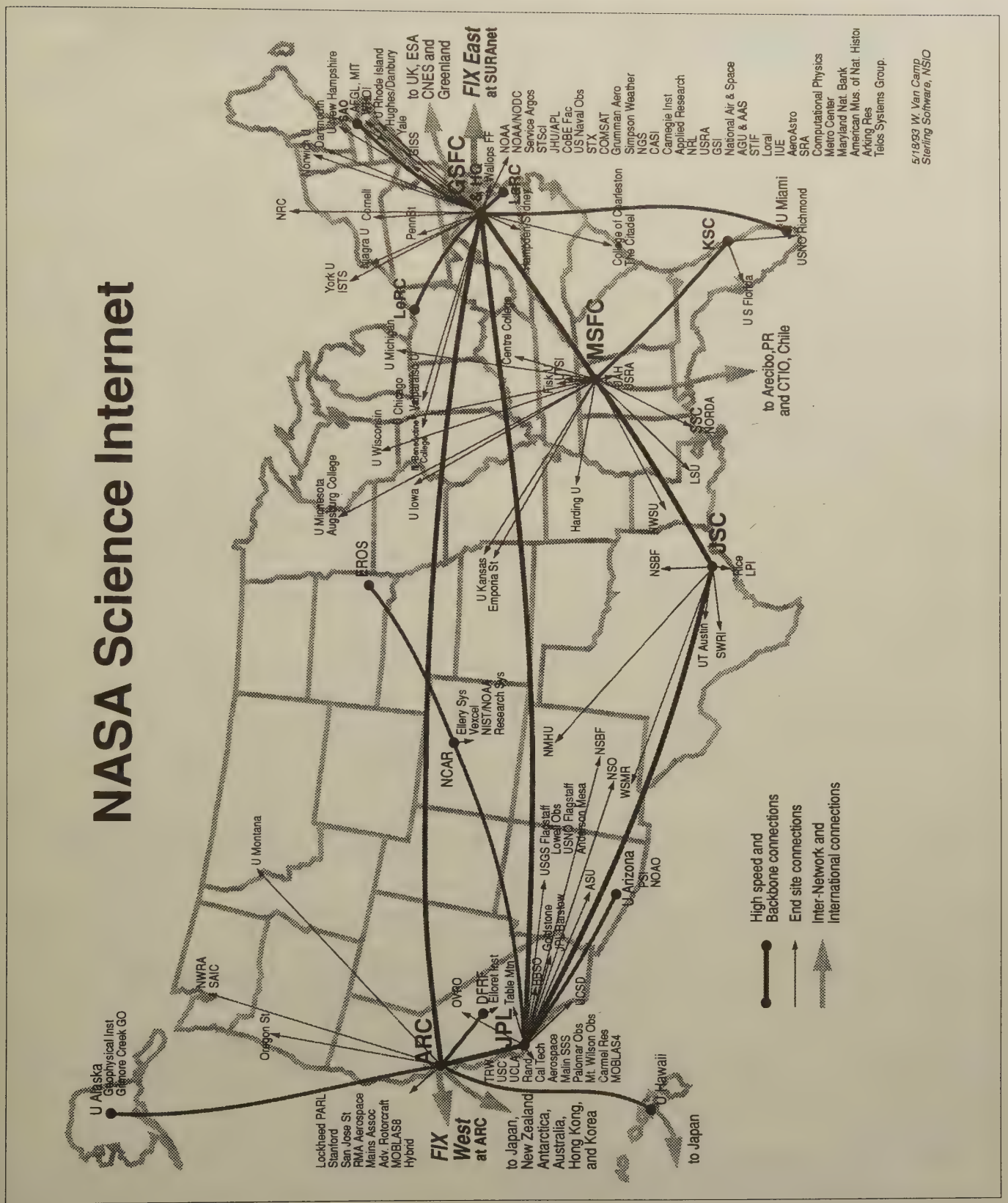
## *Version 2 of Science Data Plan Available*

**Version 2.0 of the Science Data Plan (SDP) for the EOS Data and Information System covering EOSDIS Version 0 (V0) and beyond is now available. The SDP is the high-level plan for archiving data in the EOSDIS, and for the data services to be provided to the user community by the V0 EOSDIS. It presents inventory listings of the V0 DAAC data holdings and maps the data to the objectives of the U.S. Global Change Research Program (GCRP).**

**This SDP presents the EOSDIS planning for Earth observations data to be available through the EOSDIS data archival system. The SDP initially covers the EOSDIS V0 time-frame through Fiscal Year 1995, when V0 is scheduled to be operational as a working prototype. This document will be periodically expanded to cover planning for additional data holdings beyond 1995, eventually extending to the operational EOSDIS, which will contain data from both the U.S. EOS and international EOS spacecraft.**

**The document can be obtained by contacting:**

**EOS Project Library, Code 420**
**Goddard Space Flight Center**
**Greenbelt, MD 20771**
**Attention: Librarian**
**Telephone: (301) 286-5641**
**FAX: (301) 286-4098**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at SURAnet
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## Adoption of HDF as the EOSDIS Standard Data Format

**Ted Meyer**, Instrument Science Software Manager

The Earth Science Data and Information System (ESDIS) Project has conducted a thorough study of available data format standards over the last three years. This analysis included input from the Distributed Active Archive Centers (DAACs), EOS Instrument Investigators, related Earth science projects, international investigators, computer scientists, and other members of the EOS community. As a result of this study, the ESDIS Project selected the National Center for Supercomputer Application's Hierarchical Data Format (HDF) as the Standard Data Format (SDF) for the Version 0 System distribution of science data.

Version 0 experience with HDF has included use by six DAACs, the Pathfinder project, and associated Earth science projects. Based on this successful experience, the ESDIS Project plans to adopt HDF as the baseline EOSDIS Standard Format for science and science-related data. The ESDIS Project will support the evolution of the HDF as needed to meet the requirements of science data users and producers.

Starting in September 1993, following a period of user comment, HDF will be adopted as a baseline standard for EOSDIS Core System development of standard data product generation, archival, ingest, and distribution capabilities. Members of the EOS community are encouraged to provide feedback on the impacts of this decision to the ESDIS Project. Please address any questions or comments to:

Ted Meyer
Code 505
Goddard Space Flight Center
Greenbelt, MD 20771
(301) 286-9330
E-Mail: ted@eosscswl.gsfc.nasa.gov

## What is "The Processor"?

**Ted Meyer**, Instrument Science Software Manager, and **Terri Wolfrom**, CTA Inc.

The EOSDIS Science Data Processor ("The Processor") is a quarterly newsletter intended to provide an interesting vehicle to exchange information and establish a dialog between the many elements involved in EOSDIS. A "lean and mean" size (no more than eight pages) is designed to keep articles focused and readers interested.

Articles are currently drawn primarily from Earth Science Data and Information System (ESDIS) Project personnel at GSFC. The staff wishes to expand its sources for articles beyond the Project office. Articles and comments from scientists, DAACs, NASA Headquarters, and other interested parties are welcome. They should be sent to:

Terri Wolfrom
CTA Incorporated
4601 Forbes Boulevard, Suite 210
Lanham, MD 20706
Phone: (301) 459-3300 ext.241
E-mail: twolfrom@gsfcmail.nasa.gov

*The Processor* is distributed at no charge to scientists and data processing professionals associated with the EOSDIS. Requests for subscriptions should be sent to:

Kelly Whetzel
Jorge Scientific Corporation
7500 Greenway Center Drive, Suite 1130
Greenbelt, MD 20770
Phone: (301) 220-1701
E-Mail: swager@gsfcmail.nasa.gov

## NASA and Mission To Planet Earth Budget News

From *EOS. NEWS* — June 28, 1993

The U.S. House of Representatives reported an appropriations bill containing budgets for NASA on June 10. The total appropriation for fiscal year 1994 (FY94) is $14,471 million, a 1% increase over FY93 and 5% less than requested by the President. Mission to Planet Earth (MTPE, which includes EOS) would be funded at $1,085M in FY94 and $1,147M in FY95. The Consortium for International Earth Science Information Networks (CIESIN) would receive $10M as long as matching funds were available. The bill also tasked NASA with establishing a Global Change Data and Information System and to produce a report on access to classified data sets. The legislative schedule remaining:

June 30: Deadline for passing appropriations bills in the House. Summer: Senate receives appropriations bills for review by committees, for debate and for conference; voting is usually late in the summer. Sept. 30: If appropriations bills are not enacted, a continuing resolution must be passed for the fiscal year beginning October 1.

## EOS Science Calendar

| | |
|---|---|
| September 14-15 | ECS SRR**, NASA/GSFC, Bldg. 8. Contact Carol Dibble at (301) 286-4237; cdibble@gsfcmail.nasa.gov or Debby Critchfield/ECS Hughes at (301) 925-0373; dcritchf@eos.hac.com |
| Sept. 27 (tentative)-28 | MODIS Calibration Working Group Meeting, NASA/GSFC. Contact David Herring at (301) 286-9515. |
| Sept. 29-Oct. 1 | MODIS Science Team Meeting, NASA/GSFC. Contact David Herring at (301) 286-9515. |
| October 4-6 | EOS Payload Panel Meeting, Herndon, VA. Contact Berrien Moore at (603) 862-1766. |
| October TBD | GLAS Science Team Meeting, location TBD. Contact Bob Schutz at (512) 471-4267. |
| October 5-6 (tentative) | TES Science Team Meeting, JPL, Pasadena, CA. Contact Reinhard Beer at (818) 354-4748. |
| October 5-7 | AIRS Science Team Meeting, U. of Wisconsin, Madison, WI. Contact George Aumann at (818) 397-9534. |
| November 8-12 | ASTER U.S. and Japanese Joint Science Team Meeting, Japan. Contact Dave Nichols at (818) 354-8912, or Anne Kahle at (818) 354-7265. |
| November 16-18 | 1st International MIMR Science Team Meeting, ESTEC, Netherlands. Contact Roy Spencer at (205) 544-1686, or Cris Readings, (ESTEC) +31-1719-85674. |

** The Science Advisory Panel and the Science Members of the Focus Teams have already been invited to attend.

### Correction

The previous issue identified as Volume 6, No. 2, March/April 1993 should have read Volume 5, No. 2.

# Global Change Calendar

• 1993 •

| | |
|---|---|
| August 18-21 | IGARSS'93 will be the thirteenth of its kind and will be held jointly with the Institute of Electronics, Information and Communication Engineers of Japan, and the International Union of Radio Science (URSI) at the Kogakuin University, Tokyo, Japan. For registration details, contact: Prof. Mikio Takagi, IGARSS'93 Executive Committee, University of Tokyo, Institute of Industrial Science, 7-22-1 Roppongi, Minato-ku, Tokyo 106, Japan. |
| August 24-26 | "Land Information From Space-Based Systems," Twelfth William T. Pecora Remote Sensing Symposium, Sioux Falls, South Dakota. Sponsored by the U.S. Geological Survey in cooperation with other Federal agencies. Contact: Dr. Robert Haas, Symposium Chairman, phone: (605) 594-6007; or Dr. James W. Merchant, Program Chairman, phone: (402) 472-7531, FAX: (402) 472-2410. |
| September 8-10 | International Exhibition & Conference, "MARIGLOBE 93," International Forum in Bremen, Germany. Subject of the conference: 1) Global Change and the Oceans; 2) Use of the Oceans and Marine Measurement Technology; 3) Aerospace Support for Monitoring of the Marine Environment; 4) Environmentally Safe Ocean Transport. For more information contact: Frank Reimers and Peter Grazé, phone: 0421-36 66 219, or 36-66-216. |
| September 9 | Tenth Thematic Conference on Geologic Remote Sensing. Contact ERIM, phone: (313) 994-1200, ext. 3234; FAX: (313) 994-5123. |
| September 14-15 | TERRA-2 Conference at Chester College: "Understanding the Terrestrial Environment: Data Systems and Networks." Further details can be obtained from: Prof. P.M. Mather, Department of Geography, The University of Nottingham, NG7 2RD, United Kingdom., phone: 0602 515430; FAX: 0602 515428; E-mail: mather@uk.nott.vax |
| October 18-21 | Call for papers. Thirty-Second Hanford Symposium on Health and the Environment, "Regional Impacts of Global Climate Change: Assessing Change and Response at the Scales that Matter." Send abstracts and inquiries to Ray Baalman, Planning and Communications, MSIN: K1-50, Life Sciences Center, Battelle, Pacific Northwest Laboratories, Richland, WA 99352, phone: (509) 375-3665; FAX: (509) 375-3686. |
| October 27-28 | Fourth Conference on Earth Observations & Global Change Decision Making: A National Partnership. Theme: "Global Change: A New Direction for Decision Making, " National Press Club, Washington, D.C. Sponsored by NASA, NOAA, and ERIM. Contact Robert Rogers, ERIM, phone: (313) 994-1200, ext. 3382; FAX: (313) 994-5123. |
| December 6-10 | American Geophysical Union Fall Meeting, San Francisco, California. Contact Kristan Hanson, 1630 Connecticut Ave., N. W., Washington D.C 20009, phone: (202) 462-6910, FAX: (202) 328-0566. |

• 1994 •

| | |
|---|---|
| January 23-28 | 74 th Annual Meeting of The American Meteorological Society, Nashville, Tennessee. Contact Yale Schiffman, 1701 K Street, N.W., Suite 300, Washington, D.C. 20006-1509, phone: (202) 466-6070; FAX: (202) 466-6073. |
| Jan. 31-Feb. 2 | Second Thematic Conference on Remote Sensing for Marine and Coastal Environments: Needs, Solutions, and Applications, New Orleans, Louisiana. Contact: Robert Rogers, ERIM, P.O. Box 134001, Ann Arbor, MI 48113-4001, phone: (313) 994-1200, ext. 3382, FAX: (313) 994-5123. |
| March 1-4 | 7th Australasian Remote Sensing Conference, Melbourne, Australia. The Conference will be held in conjunction with: 1.) The Inter-Congress Symposium of Commission 5 of the International Society for Photogrammetry and Remote Sensing (ISPRS), 2.) The second Australian Photogrammetric Conference, and 3.) The Pacific Ocean Remote Sensing Conference (PORSEC 94). Contact: Michael McLean/Secretary to the Organizing Committee, 7th ARSC Conference Secretariat, P.O. Box 29, Parkville, Victoria 3052 Australia, phone: (03) 387 9955, FAX: (03) 387 3120 |
| May 9-12 | Tenth Thematic Conference on Geologic Remote Sensing: Exploration, Environment, and Engineering, San Antonio, Texas. Contact: Dr. Robert H. Rogers, ERIM, P.O.Box 134001, Ann Arbor, MI 48113-4001, phone: (313) 994-1200, ext. 3382, FAX: (313) 994-5123. |

# The Earth Observer

The Earth Observer is published by the EOS Project Science Office, Code 900, NASA/Goddard Space Flight Center, Greenbelt, Maryland 20771, telephone (301) 286-3411, FAX (301) 286-3884. Correspondence may be directed to Charlotte Griner at the above address. Articles, contributions to the meeting calendar, and suggestions are welcomed. Contributions to the meeting calendar should contain location, person to contact, and telephone number. To subscribe to *The Earth Observer*, or to change your mailing address, please call Hannelore Parrish at (301) 513-1613, or send message to Internet address: hparrish@ltpsun.gsfc.nasa.gov, or write to the address above.

**The Earth Observer Staff:**
**Executive Editor:** Charlotte Griner
**Technical Editor:** Renny Greenstone
**Associate Technical Editor:** Bill Bandeen
**Assistant Editor:** Mary Odell
**Design and Production:** Winnie Humberson
**Distribution:** Hannelore Parrish


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Craig Motell
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